constructing a plurality of surfaces within the scene, each surface consisting of a plurality of points; and

B1 Cont

approximating an illumination effect of each of the finite light sources by the use of a single point light source of varying intensity.

7. (Amended) A method for illuminating surfaces in a computer-modeled scene comprising the steps of:

B2

constructing a plurality of hemispherical light sources of finite radius;

constructing a plurality of surfaces within said scene, said surfaces consisting of a plurality of points; and

approximating an illumination effect of each of the hemispherical light sources by the use of a plurality of point light sources.

REMARKS

The Office Action dated December 20, 2000 and the Advisory Action of March 28, 2001 have been received and carefully noted. The above amendments and the following remarks are submitted as a full and complete response thereto. Claims 1 and 7 have been amended to more particularly point out and distinctly claim the present invention. No new matter has been added. Claims 1-10 are respectfully submitted for consideration.

Applicant wishes to thank the Examiner and the Examiner's Supervisor for extending the courtesy of an interview on May 18, 2001. The discussion were helpful and Applicant submits the amended claims in view of that discussion. Claims 1-10

B

remain rejected under 35 U.S.C. §103(a) as being unpatentable over *Nishita et al.* ("Continuous Tone Representation of Three-Dimensional Objects Illuminated by Sky Light", Computer Graphics, Vol. 20, No. 4, August 1986) in view Persistence of Vision®'s Ray-Tracer software ("POV-Ray", 1997). The above rejection is respectfully traversed based on the remarks that follow.

Nishita et al was submitted with Applicant's prior response and Applicant is well acquainted with its disclosure. The reference is directed to modeling of natural light, that considers both direct sunlight and scattered ambient light. The "skylight" is modeled as a hemisphere with a large radius. The hemisphere is subdivided into bands and the light intensity of individual bands is calculated.

The POV-Ray reference is directed to software used to create three-dimensional, photo-realistic images using a rendering technique called ray-tracing. The program description section of the documentation, not cited by the Office Action, provides further description of the software. "It [The program] reads in a text file containing information describing the objects and lighting in a scene and generates an image of that scene from the view point of a camera also described in the text file. *Ray-tracing is not a fast process by any means*, but it produces very high quality images with realistic reflections, shading, perspective and other effects." {emphasis added}

The POV-Ray reference is in fact a good example of a prior art system that creates the type of soft light transition effect produced by the spherical pseudo area light. It is a brute force, calculation intensive method that makes no attempt at the cognitive leap necessary to reduce or eliminate its computational cost.

With respect to the rejection of claims 1-10, Applicant respectfully asserts that the obviousness rejection is improper because 1) the references fail to teach or suggest all of the elements of the claims; and 2) fails to consider or overcome the indicia of nonobviousness provided in the specification and discussed in Applicant's previous response.

Claim 1 recites, in part, "approximating an illumination effect of each of the finite light sources *by the use of a single point light source*." *Nishita et al.* does not teach or suggest taking into account the illumination effect of the finite light sources through the use of single point light source. *Nishita et al.* uses regular slices or bands of the hemisphere and there is no appreciation for the use of point light sources. In fact, the Office Action acknowledges that *Nishita et al.* fails to positively disclose the use of point light sources.

Because of this deficiency, the Office Action applies the POV-Ray reference for its alleged teaching of the use of a plurality of point light sources to approximate other lighting effects. However, the POV-Ray reference fails to teach the use of a single point light source to accomplish that approximation. Given the lack of disclosure, Applicant respectfully asserts that the claim 1, and claims dependent thereon, would not have been obvious in view of the *Nishita et al.* and the POV-Ray reference.

Additionally, the references also fail to teach or suggest the subject matter of claims 7-10. Claim 7 specifies that "a plurality of hemispherical light sources" are constructed and the plurality of hemispherical light sources are approximated by a point light source. While the Office Action discusses *Nishita*'s alleged teaching of a hemispherical light in considering "skylight," a plurality of hemisphercial light sources

are not taught or suggested. The method steps of claim 7 also would not have been obvious because *Nishita et al.* is directed to approximating skylight and would have no need to construct and approximate for multiple hemispherical light sources. Such an approximating step is neither taught nor suggested by either of the proffered references.

As such, Applicant respectfully asserts that the claim 7, and claims dependent thereon, would not have been obvious in view of the *Nishita et al.* and the POV-Ray reference.

In addition, the rejection fails to consider or overcome the indicia of nonobviousness provided in the specification and discussed in Applicant's previous response. When evidence of any secondary considerations is submitted, the Examiner must evaluate the evidence. M.P.E.P. 2141.

The rejection alleges, in effect, that the POV-Ray software, coupled with *Nishita et al.*, can approximate the effect of any type of area light source and that such approximation is an obvious extension of *Nishita et al.* However, if such an extension were obvious, it would be in widespread use throughout the industry. This is due to the fact that the cost of implementing a spherical pseudo area light is virtually nil, and the effect is much more realistic illumination. The pursuit of realism and lower computational cost are the two dominant driving forces in the industry. The fact that such an implementation, which addresses both these goals, does not exist is a clear demonstration that such an extension is not obvious.

In addition, even if the references were somehow combined, they would not reduce computation time nor cost. As discussed above, the POV-Ray software teaches away from efficiency and instead emphasizes photo-realistic results. The combination

of references cited in the rejection would not provide the benefits of the present invention. The Examiner is respectfully requested to consider the above noted benefits in reconsidering the prior rejections.

As such, Applicant respectfully asserts that the rejection of claims 1-10 is improper and should be withdrawn. Applicant also respectfully requests that the application be allowed to proceed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the Applicant's undersigned attorney at the indicated telephone to arrange for an interview to expedite this position of this application.

In the event this paper is not being timely filed, the Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to counsel's Deposit Account No. 01-2300.

Respectfully submitted,

ARENT FOX KINTNER PLOTKIN KAHN, PLLC

Kevin F. Turner
Attorney for Applicant
Reg. No. 43,437

Atty. Docket No. 022972-00007
1050 Connecticut Avenue, N.W., Suite 600
Washington, D.C. 20036-5339
Tel (202) 857-5000
Fax (202) 638-4810

KFT:ejb

MARKED UP COPY OF REWRITTEN MATERIAL

1. (Amended) A method for illuminating surfaces in computer graphics comprising the steps of:

constructing [one or more] a plurality of finite light sources within a computer animated scene, each of the finite light sources having a finite size and a center;

constructing a plurality of surfaces within the scene, each surface consisting of a plurality of points; and

approximating [approximation of the] an illumination effect of each of the finite light sources by the use of a [plurality of] single point light source [sources] of varying intensity.

7. (Amended) A method for illuminating surfaces in a computer-modeled scene comprising the steps of:

constructing a plurality of hemispherical light sources of [infinite] finite radius;

constructing a plurality of surfaces within said scene, said surfaces consisting of a plurality of points; and

approximating [the] an illumination effect of each of the hemispherical light sources by the use of a plurality of point light sources.